

Why Some People Are Mosquito Magnets

Analysis by [Dr. Joseph Mercola](#)

✓ Fact Checked

November 12, 2022

STORY AT-A-GLANCE

- › Differences in skin odors are a potential major player in whether you're eaten alive by mosquitoes or passed up for a more enticing snack
- › The most enticing scents to mosquitoes came from people with higher levels of carboxylic acids, which are produced in sebum, an oily compound that helps keep skin moisturized
- › Compared to the least attractive scents, the sample that attracted the most mosquitoes had a score more than 100 times greater
- › This aligns with prior research that found links between skin microbes and mosquito bite frequency, as beneficial bacteria on the skin "chew on these acids" to produce the characteristic smell of humans
- › It's possible that people may also emit a natural repellent that counteracts the attractiveness of carboxylic acids

Have you ever gone for a hike with a friend and come home covered in mosquito bites, while your friend had none? It's a fact that some people are veritable mosquito magnets while others seem to have an invisible shield against these bothersome pests.¹ Exactly why mosquitoes are more attracted to certain hosts than others is more hotly debated.

The composition of microbiota on human skin was previously found to play a role in attractiveness to mosquitoes, specifically the African malaria mosquito *Anopheles*

gambiae sensu stricto.² People with a high abundance, but low diversity, of bacteria on the skin emerged as the food of choice for these particular bugs.

Research published in the journal *Cell* shed more light on the issue, this time regarding the *Aedes aegypti* mosquito species (*A. aegypti*), which carries yellow fever, dengue fever, chikungunya, Zika and West Nile,³ among other diseases. This time, differences in skin odors emerged as a potential major player in whether you're eaten alive by mosquitoes or passed up for a more enticing snack.⁴

Researchers Explore What Makes a 'Mosquito Magnet'

Many theories exist about why mosquitoes target, or avoid, certain people. Among them, blood type ABO has been suggested as a mosquito magnet while eating garlic and B vitamins has been suggested as a natural repellent.

However, research to support these theories is lacking. It's also been found that pregnancy and drinking beer make a person more attractive to mosquitoes,⁵ but this doesn't explain differences in the rest of the population.

A. aegypti are attracted to living warm-blooded creatures, which they detect, in part, due to the carbon dioxide and body heat such organisms emit. However, skin odor may provide cues as to whether a target is a human or nonhuman animal and, within the human species, whether they're a particularly sought-after individual.

The odor of your skin is made up of organic compounds. Not to be confused with armpit odors, human skin emits a less intense odor that typically goes unrecognized among humans but may stand out to mosquitoes. To find out, a team of researchers had 64 adults wear nylon stockings on their arms to gather their unique smell.⁶

The nylons were then placed in a container with female *A. aegypti* mosquitoes. Although female mosquitoes live only three to six weeks, each one bites multiple humans during this timeframe in order to consume enough protein to lay eggs up to every four days.

“This repetitive human-directed feeding behavior allows the mosquito to contract and transmit pathogens in successive bites,” the researchers wrote in Cell. “Aedes aegypti are efficient vectors of disease because they specialize on human hosts, thereby focusing pathogen transmission on our species.”⁷

Certain Skin Odors May Make You an Enticing Mosquito Snack

For the study, two nylons from different people were placed into one container at a time, to evaluate whether one was more enticing to mosquitoes than the other. Over several months, researchers tested multiple nylons, revealing that certain scents were, indeed, more enticing to mosquitoes than others. Compared to the least attractive scents, the sample that attracted the most mosquitoes had a score more than 100 times greater.⁸

For the next step, researchers analyzed the scent profiles to determine what might account for the differences. The most enticing scents to mosquitoes came from people with higher levels of carboxylic acids, which are produced in sebum, an oily compound that helps keep skin moisturized.⁹

This aligns with prior research that found links between skin microbes and mosquito bite frequency, as beneficial bacteria on the skin “chew on these acids,” which produces the “characteristic smell of humans,” according to study author Leslie Vosshall, a professor at Rockefeller University.¹⁰ The study noted:¹¹

“Highly attractive subjects produced significantly higher levels of three carboxylic acids – pentadecanoic, heptadecanoic, and nonadecanoic acids – as well as 10 unidentified compounds in this same chemical class. The specific blend of these and other carboxylic acids varied between different high attractive subjects. Therefore, there may be more than one way for a person to be highly attractive to mosquitoes.”

Further, one subject produced high levels of carboxylic acids yet turned out to be only minimally attractive to mosquitoes. It’s possible that this person may also emit a natural repellent that counteracts the attractiveness of the carboxylic acids.

Previous research found, for instance, that people who are less attractive to mosquitoes had more of certain compounds on their skin, namely 6-methyl-5-hepten-2-one, octanal, nonanal, decanal and geranylacetone.¹² These compounds may act as natural repellants, which may interact with attractants like carboxylic acids to influence an individual's overall attractiveness to mosquitoes.

You're a Mosquito Magnet for Life

There are other variables as well, since mosquitoes are opportunistic hunters. If you're alone, you may get bitten more often, even if you have "low" attractiveness, simply because you're the only option for dinner. In a group setting, however, mosquitoes may opt for a more attractive host since they have the choice.¹³

There's also likely a genetic component, as research has found that identical twins tend to be similarly attractive to mosquitoes – more so than fraternal twins.¹⁴ In terms of skin odors, however, skin maintains a consistent level of carboxylic acids over time. So if you have an attractive odor to mosquitoes, it's likely to stay that way for good – or bad.

"This property of being a mosquito magnet sticks with you for your whole life – which is either good news or bad news, depending on who you are," Vosshall told *Scientific American*.¹⁵ As for why mosquitoes love the scent of carboxylic acids so much, the researchers speculated it could be because it's a uniquely human scent.

Humans emit carboxylic acids more so than other animals, and it's possible mosquitoes evolved to prey on humans because they often had water nearby, which is where mosquitoes breed. So mosquitoes may have evolved to weed out humans over other mammals by "sniffing" out their carboxylic acids.¹⁶

Long-Lasting Mosquito Repellent in the Works?

Researchers are now using the findings to develop individualized mosquito repellants that could work with your skin's microbiome. Omar Akbari, a cell and molecular biologist at the University of California, who was not involved in the featured study, is working on

a project called ReVector, which is funded by the Department of Defense's Defense Advanced Research Projects Agency (DARPA).^{17,18}

The program is working to create long-lasting mosquito repellants for military personnel by altering volatile molecules on the skin. According to DARPA:¹⁹

“Mosquitoes are attracted to the general area of humans by volatiles emitted in human breath. However, it is the heat and volatile molecules from human skin that direct mosquitoes to the specific sites on the body where they feed. Many of those volatile molecules are produced by the metabolism of organisms in the skin microbiome.

Researchers on the ReVector program are working to develop precise, safe, and efficacious technologies to modulate the profile of skin-associated volatile molecules by changing the organisms that are present in the skin microbiome and/or their metabolic processes.”

The ReVector treatments could be applied hours before needed and would last up to two weeks.²⁰ Akbari explained to Scientific American, “The idea is taking human-colonizing skin bacteria ... and engineering them in such a way that they can either express a repellent compound or be able to degrade something that's attractive.”²¹

Vector-borne diseases cause more than 17% of infectious diseases worldwide and cause more than 700,000 deaths annually.²² Many vectors are bloodsucking insects like mosquitoes, so there's no question that mosquito control – and protection against bites – is important.

However, ReVector's ties to DARPA are cause for concern, given its long history of surveillance, including using medical and non-medical data to prevent terror attacks. DARPA managed Total Information Awareness (TIA), a program that sprang up after the 9/11 attacks that was seeking to collect Americans' medical records, fingerprints and other biometric data, along with DNA and records relating to personal finances, travel and media consumption.²³

They also worked on the development of an injectable biosensor with its maker, Profusa.²⁴ The sensor allows a person's physiology to be examined at a distance via smartphone connectivity. Profusa is also backed by Google, the largest data mining company in the world – just some food for thought to put this potential new mosquito repellent into perspective. This might not be the agency you want tinkering with the microbes on your skin.

Not convinced yet? Do a little reading on DARPA's 2016 "Insect Allies" project.²⁵ The gist? Take some insects, infect them with a genetically engineered (GE) virus designed to genetically edit mature plants in real time and release them.

DARPA's official story was that, in the name of national security, a good way to protect the American crops from potential threats is to genetically modify them using GE viruses as genetic modifiers and insects as flying syringes. What could possibly go wrong?

Getting Bit? Natural Mosquito Repellent Options

Since it's unlikely you'll be changing your skin's odor anytime soon, taking steps to reduce mosquitoes in your immediate vicinity makes sense. By this, I don't mean spraying chemicals or releasing GE mosquitoes, like biotechnology company Oxitec is doing in Florida.²⁶

Mosquitoes breed in standing water, including that found in pet bowls, gutters, garbage and recycling bins, spare tires, bird baths and children's toys. Draining these water sources can help eliminate mosquitoes from your yard. Using a house fan in your backyard is another natural strategy to keep mosquitoes away while you're outdoors.

Strategic planting of marigolds, which mosquitoes tend to stay away from, is another option, as is installing a bat house, as mosquitoes are one of their favorite meals. If you think this isn't likely to make a difference, think again. Even small bats eat 1,000 or more insects in one hour, while nursing bats may eat more than 4,500 insects a night.²⁷

To avoid getting bitten, wear long sleeves and pants in mosquito-prone areas and use natural insect repellants (not synthetic chemical versions) like cinnamon leaf oil, citronella essential oil or catnip oil, as necessary.

Do not wear perfume, which may attract mosquitoes (not to mention its health concerns) and avoid dark-colored clothing, which also draws them in. Peak biting hours for mosquitoes are from sunset to sunrise, so if you can time your outdoor activities around these hours, you'll also naturally reduce your chances of getting bitten.²⁸

Sources and References

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